161 of which ceased, only one was prohibited by the Government. In addition to those above-mentioned, we find in the list works on etiquette, accounts, naval and military works, dictionaries, encyclopædias, &c. The total number of works published during the year was 4910 against 3792 last year. Very many of these books are translations or adaptations of European or American works. Among such books recently "conveyed" we find Smiles's "Character," Roscoe's "Chemistry," Leone Levi's "International Commercial Law," Bouvier's "Law Dictionary," Palgrave's "Chairman's Handbook," Lord Chesterfield's "Letters," "Every Man his own Lawyer," Taylor's "Medical Jurisprudence," Thompson's "Social Science and National Economy," Baxter's "London Statistics," "The Science of Familiar Things," Mill's "Three Essays on Religion," Draper's "Conflict of Religion and Science," portions of Buckle's "History of Civilisation," Thompson's "Outline of the Necessary Laws of Thought," &c. As to the price of these works, we may instance Smiles's "Character," the translation of which by Nakamura, a well-known English scholar, in two volumes, costs only 50 *sen*, or about a shilling at the present rate of the paper currency. The figures and facts here recorded show at least that the path of western progress which the Government is pursuing, is one in which the people desire to take a part.

We have received from the President of the University of Tokio a copy of the calendar of that Institution for the past year. It is printed in Japanese and English, and thus appears somewhat more bulky than its actual contents would warrant. In the preface, a brief account is given of the growth of this large and apparently flourishing establishment from its first small commencement as a bureau for translating foreign books. We have heard so much recently of the changes in the *personnel* of the Japanese educational institutions from foreign to native teachers, that we turn with some interest to the list of professors. In the department of law we find one foreign and eight native teachers (including in this term professors, lecturers, instructors, &c.). This subject is exceptional, as there are five professors of Japanese law. In science, of the twenty-six teachers, eighteen are natives, and we believe this number has increased recently; and in literature three of the fourteen teachers are foreigners. Judging simply by the degrees which they have obtained in western universities, most of the Japanese gentlemen seem well qualified for their work. This great and rapid displacement of foreign instructors is certainly a delicate experiment, and we can only hope that it may be successful. *Chi va piano va sano* is a motto which may be commended to Japanese attention in this respect as in many others. The students can hardly complain of excessive charges. The tuition fee for each term (of which there are three in the year) is only four *yen*, nominally 16*s.*, but at the present rate of the currency rather less than 9*s.*; while the cost for a term of living, fire, light, &c., is only fourteen *yen*, or about 32*s*. The total number of students attending the college is 205. The examination papers, which are given in full, seem to be quite up to the standard for similar examinations in this country. We are glad to observe that Japanese literature and history are not neglected in the study of more western subjects. A large number of teachers have been provided for these subjects.

Prof. Civiale is preparing a large photographic work on the Alps. For ten years, from 1859 to 1868, the author travelled in the Alps with his camera, constantly taking panoramic and smaller (detailed) views. The latter, some 600 in number, principally show the glaciers with their crevasses, moraines, and the rocks forming their banks, the mountains, valleys, glens, natural geological sections, the rocky eminences groved, polished, or ground by former glaciers, and the course of various rivers. The panoramic views, forty-one in number, are taken from the summits, and comprise all the large Alpine chains. Each consists of a number of plates, and twenty include the whole circle of view. These valuable plates are accompanied by two maps in 1 : 600,000, one is specially orographical, the other shows the curves of the panoramic views. Thirteen years were necessary to put the material collected into proper order, to replace the photographic plates by printed ones, to draw and engrave the maps, and to write the text.

The recent remarkably low level of nearly all the Swiss lakes has encouraged the scientific circles of Switzerland to make fresh researches with regard to pile-dwellings. The societies of the Canton of Thurgau have investigated the Untersee (the lower part of the Lake of Constance), near Steckborn, in the vicinity of the former monastery of Feldkirch. The Untersee was surrounded by a complete circle of pile-dwellings, and the present investigations have yielded valuable results, in the shape of a long list of the most varied objects which have been brought to light.

The Russian Society of Painters has started a new publication, which will be of interest, not only for lovers of the Fine Arts, but also for science. It is a periodical, "Art in Central Asia," being a collection of well printed drawings of Central Asian architectural ornaments, carpets, paintings, and so on, published under the supervision of M. Simakoff and of the above-named society.

We learn with pleasure that a special "Geological Committee" has been instituted in Russia, at the Department of Mines, for a systematic geological exploration of Russia, and for the preparation of a detailed geological map of the country. The Government has allowed an annual grant of 3000*l.* for the expenses of the Committee and for its publications.

Dr. Rae points out that, according to the Royal Geographical Society's *Journal*, the late Pundit Nain Singh was awarded not the Royal Medal, but a gold watch.

We have been requested to state that the late Dr. T. Romney Robinson was born in the year 1792, and not in 1793, as stated erroneously in the obituary notice which recently appeared in our columns.

The additions to the Zoological Society's Gardens during the past week include two Bonnet Monkeys (*Macacus radiatus* ♀ ♀) from India, presented respectively by Mr. Henry Worth and Mrs. Nicholson; three Herring Gulls (*Larus argentatus*), British, presented by Mr. Rowland Ward; a Herring Gull (*Larus argentatus*), British, presented by the Chevalier Da Costa Ricci; a Sclater's Curassow (*Crax sclateri* ♂), a King Vulture (*Gypagus papa*) from the Province of Alagoas, Brazil, presented by Mr. Frederick Youle; a Puffin (*Fratercula arctica*), British, presented by Mr. H. M. Upcher; two Grey Ichneumons (*Herpestes griseus* ♂ ♀) from India, two Tayras (*Galictis barbara*) from Brazil, a Wild Boar (*Sus scrofa*), European, deposited.

OUR ASTRONOMICAL COLUMN

The Great Comet of 1881.—In the *Monthly Notices* of the Royal Astronomical Society for January there are published two letters addressed to the secretaries by Dr. W. Bone of Castlemaine, Victoria, referring to an object seen near the great comet of last year, on the evening of June 10. In a telegram which he sent to the Melbourne Observatory the same night, he described it as discoid and like a circular comet, and states it had travelled south 6′ in thirty-four minutes; its place at 6h. 45m. in R.A. 5h. 18m 30s., Decl. – 14° 24′. He asked that search might be made at Melbourne, but mentions that his telegram was not answered. In his first letter he writes: "On June 10, 1881, whilst measuring the position of the comet, then visible here at 5h. 52m. mean time of place, I noticed a peculiar discordance in each succeeding measure, and at length found that the star (?) from which I was measuring was a rapidly-moving body." He found it "somewhat discoid, but its light, although bright, was diffused and hazy," and adds that it had moved through six minutes of arc in a *northerly* direction, contrary to what was stated in his telegram. The approximate place for 5h. 52m. mean time (as we take it) was in R.A. 5h. 18m. 8s., Decl. – 14° 18′, showing that a southerly motion was intended. In his second letter Dr. Bone says: "I should place the magnitude at about 2·5, for it was visible to the naked eye in first twilight;" though the telegram has what in this case was somewhat unnecessary information: "No asteroid in that place."

An observation of this kind would hardly perhaps have required strict examination, were it not that about thirty-eight hours later Dr. B. A. Gould, at Cordoba, compared the comet with an object which he could not afterwards identify, and after much hesitation, through fearing some great error, he communicated the particulars to the *Astronomische Nachrichten*, No. 2384. We have already referred to these observations in this column (NATURE, vol. xxiv. p. 342). At 10h. 58m. 9s. sidereal time, on June 11, Dr. Gould made a rough preliminary determination of the comet's place, for the purpose of finding a comparison-star, when he says he found one in the field; with this star he compared the comet four times, the results being:—

Cordoba Sidereal Time.				Comet followed.		Comet South.	
h.	m.	s.		s.		′	″
11	8	49	... ...	49	... ...	5	12·9
—	11	2·5	... ...	49	... ...	5	8·3
—	13	11·0	... ...	48	... ...	5	8·5
—	14	37·5	... ..	48·5	... ...	5	2·8

The rough place of the comet by the circles of the equatorial, agrees sufficiently well with that we now know it must have occupied at the time, but if the comet had been observed during the micrometrical comparisons, the position of the supposed star would have been 5h. 10m. 23s., Decl. –9° 29′·8, where no star has been catalogued, though Dr. Gould thought it would hardly be below the third magnitude, and he could rather believe it as bright as the second.

In *The Observatory* for January, Mr. Christie has printed a letter from the able amateur, Mr. John Tebbutt, of Windsor, New South Wales, suggesting an explanation of Dr. Gould's observation which merits attention. He made four circle-comparisons of the comet with Rigel on the morning of June 12, the last of which was only 1h. 29m. of absolute time previous to the first observation at Cordoba, and he states "there was then, I am confident, no object near the comet answering to the description already given." Were it not that the Cordoba instrumental place agreed closely with the actual position of the comet, he adds, he would be disposed to suggest that Dr. Gould had not observed the comet with the micrometer at all, but possibly the two stars, B.A.C. 1592 and 1597, "whose relative magnitudes and position agree almost exactly with his observations, and whose differential declination would gradually diminish from the effect of refraction as the stars approached the horizon."

We will now examine the case with some strictness. The following positions of the comet are calculated from the elements published by Mr. White, of the Melbourne Observatory, and will be very nearly correct for the dates in question:—

G.M.T.		True R.A.				True N.P.D.				Log. distance from the Earth.
		h.	m.	s.		°	′	″		
June 9·5	...	5	9	23·9	...	104	57	5	...	9·59144
10·0	...	5	9	50·5	...	103	39	30	...	9·58131
10·5	...	5	10	18·2	...	102	17	33	...	9·57121
11·0	...	5	10	46·9	...	100	51	6	...	9·56116
11·5	...	5	11	16·8	...	99	19	59	...	9·55121
12·0	...	5	11	48·2	...	97	44	2	...	9·54139

From the ephemeris, it follows that the comet's motion between Dr. Gould's first and last comparison was +0s.·41 in R.A., and +44″·7 in declination. The observed difference in declination was only 10″·1. If Dr. Gould had observed the comet the difference of refractions of comet and star would have been about 0·28s. and 2″·6 at the first comparison, and 0·47s. and 4″·3 at the last, so that the discordance between observed and computed motion would not be explained by the refraction.

The stars referred to by Mr. Tebbutt are Bradley 718, and 69 λ Eridani, and both are found in Mr. Stone's recently published catalogue. Their apparent places on June 11 were:—

		R A.				Decl.		
		h.	m.	s.		°	′	″
Br. 718	... ...	5	2	39·06	...	–8	49	14·6
λ Eridani	...	5	3	27·90	...	–8	54	27·8

If now, Dr. Gould, in "the exceptionally thick haze and mists of the horizon," and bright twilight which he mentions, mistook λ Eridani for the comet, and compared with Bradley 718, we have the following striking agreement:—

		In R.A.		In Decl.	
		s.		′	″
Differences of above places	...	+48·8	...	–5	13·2
By Gould's comparisons ...	...	+48·6	...	–5	8·1

Difference of refractions at first comparison, 0·7s. and 6″·5, and at the last comparison, 1·7s. and 15″·7, so that the ten seconds' change in the difference of declination measured with the micrometer is accounted for by refraction, and there is a tendency to diminishing difference of R.A. in the comparisons, which refraction would necessitate. Dr. Gould states, that these comparisons were all he could obtain "before the comet passed below the horizon," and the true altitude of λ Eridani at the last of them was 2° 17′: the altitude of the comet at the same time being 4° 15′.

Mr. Tebbutt thinks, if his suggested explanation be accepted, it will be necessary to admit "a temporary outburst in the light" of B.A.C. 1592 (Bradley 718), and it happens that there is some reason for believing that star to be variable. It is a wide double star, No. 649 of the Dorpat catalogue. Sir John Herschel, in one of his sweeps at the Cape of Good Hope, on December 26, 1836, estimated the principal component 7·8 (the companion is about 10m.): it was rated 6·0 by Struve, 6·8 by Jacob in 1849, and 6 or 7 by Lalande, Bessel, Knorre (in his Berlin chart), Santini, and others, but in Mr. Stone's new catalogue it is called 5m., or only one magnitude less than λ Eridani, which has been pretty consistently estimated a fourth.

It appears, then, that Mr. Tebbutt's explanation of the difficulty in Dr. Gould's case, is a very probable one: the instrumental comparison preceded the first micrometrical observation about ten minutes, and the assumption of course will be, that after applying the micrometer, the telescope, instead of being pointed to the comet, was turned upon the stars alluded to above, which, in the dense haze, were blurred and confused.

With respect to the observations at Castlemaine, Victoria, on June 10, it is to be regretted that Dr. Bone has not communicated the comparisons of the comet with star as entered in his note-book, and his letters having been given publicity in the official periodical of the Royal Astronomical Society, it is desirable that these should be forwarded, that the true explanation may be found. His geographical position is given in a note on the last Transit of Mercury, which appears in the same number of the *Monthly Notices*: longitude 9h. 36m. 55s. E., latitude 37° 4′ 11″ S.; that phenomenon was observed with a 4·7 inch (Wray) equatoreal, which it may be presumed was the instrument used for observing the comet. It so happens that observations were made the same evening at the Melbourne Observatory, and the earlier comparisons at the same time that Dr. Bone was similarly employed at Castlemaine, which is only 3 min. west of Melbourne. The Melbourne reference star was at first 8 Leporis, the apparent place of which was in R.A. 5h. 8m. 4·2s., Decl. – 14° 2′ 25″, therefore in the same R.A., and only 15′ north of the position which Dr. Bone assigns to the moving object at 5h. 52m. M.T. It is difficult to explain how such an object could have escaped the attention of the Melbourne observers, while they were comparing the comet with a star so close to its place. The position of the real comet may be interpolated from the above ephemeris, or it may be inferred from the Melbourne observations the same evening. The second series of comparisons were made with a star which we find to be No. 173, Hour V. of Weisse's Bessel, and reducing this series we have for the comet's place:—

	Melbourne M.T.				App. R.A.				App. Decl.		
	h.	m.	s.		h.	m.	s.		°	′	″
June 10 at	6	3	13·6	...	5	9	40·83	...	–14	3	22·1

Comparing this with the result of the earlier measures from 8 Leporis (*Monthly Notices*, vol. xli. p. 432), we have the following positions of the comet for Dr. Bone's times:—

				R.A.				Decl.		
	h.	m.		h.	m.	s.		°	′	″
At	5	52	.. ...	5	9	40·5	... ...	–14	4	15
	6	45	... ...	5	9	42·7	... ...	–13	58	32

At 5h. 52m. its true altitude was 8° 54′, but it set at 6h. 41m., four minutes before the last observation at Castlemaine. With Dr. Bone's place for his object it would be 1° above the horizon at this observation. Refraction would of course have been exercising a great effect upon any comparisons made near so

small an altitude. In the absence of the original observations, we can only conjecture that the supposed moving object or second comet, was none other than the Melbourne comparison star 8 Leporis (commonly estimated 6m.), and it may have been under this impression that Mr. Ellery did not think it necessary to reply to the telegram sent to him from Castlemaine. The motto of the Royal Astronomical Society, "*Quicquid nitet notandum*," upon the principle of which Dr. Bone says he acted in putting his observation upon record, is a good one no doubt, but where there is suspicion of error it is desirable to be in possession of all particulars, and in this view we would suggest the early publication of his comparisons as they were actually made.

A NEW COMET.—A comet discovered in America, apparently on March 18, is likely to become a conspicuous object before perihelion, which, according to the first rough orbits, does not take place until June.

MEDICAL ELECTRICITY

A PAPER "On Measurement in the Medical Application of Electricity," was read before the Society of Telegraph Engineers, by Dr. W. H. Stone and Dr. Walter Kilner, on March 9. Dr. Stone commenced by stating that the subject had been suggested by Lieutenant-Colonel Webber, the chairman, and that the details the authors proposed to give that evening were mainly preliminary to fuller treatment, which they hoped to offer at some future period.

Medical electricity, he said, had been up to now a heterogeneous mixture of loose statements, doubtful diagnosis, and erroneous therapeutics. Glaring instances of these were given. With hysteria, Metallotherapy, and magnetic appliances, they did not propose to deal: science is in far too elementary a state to see through these obscure, though real phenomena. Probably, the key to the great enigma of the connection between electricity and nerve force had yet to be found. The bold statement that "electricity is life" is demonstrably false in many particulars. Speaking generally, medical electricity had suffered from its exclusive handling by physiologists and physicians, who might receive valuable help from physicists; indeed, the writers of the paper were actually soliciting such assistance at the hands of this young and active society. Medicine and its kindred arts lend themselves ill to measurement: the tone of mind required for their practice is rather judicial than computative; it is oftener concerned with weighing evidence, and balancing alternatives, than with solving equations. But men who work by measurement are usually sterling and accurate men; indeed, Prof. Schuster has recently shown how mathematics can help science. Where measurement *can* be used, it *should* be used; and this was their text for the evening.

The speaker then proceeded to divide the forms in which electricity had been used medically into four, namely—(1) continuous currents, (2) continuous currents made to intermit, (3) induced currents, termed generally "Faradisation," (4) statical electricity. The last of these was the first employed, but it had given the least satisfactory results of any. The third method had been far the most deeply studied. Duchenne's great work on Localised Electrisation early drew attention to this department. That genuine and indefatigable observer was able to point out so many definite diagnoses, and to isolate so many new nervous and muscular diseases by means of the induction-coil, that this instrument had been given somewhat excessive prominence as a therapeutic agent. Physiologists had also found in it a convenient stimulant for testing the action of nerves and the irritability of muscle; perhaps also the localisation of brain-functions. Hence muscular contraction and the action of intermittent currents in alternate directions had been too much relied on as evidence of activity. One chief object of the paper was to point out that the future of electro-therapeutics lies more in the continuous current, used either in its first or second form, the latter of which has hitherto received little or no attention. In confirmation of these views, extracts were read from Prof. Erb's valuable memoirs in Ziemssen's Cyclopœdia of Medicine.

Before, however, a single step could be taken in this scientific path, we must have some tolerably accurate mode of measuring the agent we are employing. It is obvious that the units used should be as far as possible those generally adopted in the scientific world.

To begin with resistance: This in the human body is singularly great, and is especially located in the epidermis, which, when dry, is an excellent insulator. Wetting it wtth sulphate of zinc or common salt diminishes this resistance very materially; though even when care is taken in this respect, the residual opposition to a current is large. From hand to hand it is usually about 6000 ohms. In the larger bulk of the trunk, from the sacrum to the nape of the neck, it never, even after long wetting, sinks much under 1500 ohms. That of the head, from nape to forehead, is about 2000 ohms. In one case it was more precisely 1930 ohms, in an adult, and in another, a child, 2500 ohms. The resistance of different tissues, though not exactly to the present purpose, had been studied by Prof. Eckhard, who stated that muscle was the best conductor, and that this being taken as a unit, cartilage would have a resistance twice, tendons and nerves about 2·1, and bone nineteen times as great. Matteuci states that muscles conduct four times as well as nerves, brain, or spinal chord. The resistance of the skin varies from day to day, being modified by moisture, and by the fulness of the capillary vessels. In a particular case, the positive pole of a battery was placed on the sacrum of a child, and the other on the leg, over the extensors of the foot. By using the same current, and adding quickly a known resistance, the resistance of the body was at first found to be 11,250 ohms, which, on thoroughly soaking the skin, was reduced 2875 ohms. Three days previously, the resistance before soaking was 13,000 ohms, and after that process sank to 3000 ohms. Personal idiosyncracy exercises an influence, a delicate skin conducting better than one which is coarse. The face and neck offer the least; the soles and palms the greatest resistance. Disease causes variation of conductivity: the skin over affected muscles in lead paralysis has its resistance increased, while in many old cases of hemiplegia it is decreased to a greater or less extent according to the amount of atrophy which has taken place.

The resistance of muscle in disease is sometimes diminished, sometimes augmented. Augmentation takes place, at the commencement of degenerative changes, from the inferior conductive power of fat to that of healthy muscle. In a case of infantile paralysis, the sound leg had a resistance of 2500 ohms, the affected leg of 3250 ohms. In a wasted muscle of many years' standing, the enormous resistance of 16,500 ohms was reached. It was both easy and desirable to multiply facts such as these.

The second preliminary point was the current which could be borne with impunity. Here results were very discordant. In the three fatal cases from touching the conductors of dynamo-machines, at a music-hall, in the Russian Navy, and at Hatfield, the necessary facts for measurement were absent; although Dr. Siemens had stated that he had often taken a current sufficient to produce a powerful light with impunity. In a case now in St. Thomas's Hospital, a current of 50 milliwebers was borne with difficulty, and one of 20 milliwebers with ease and great benefit. A case of diabetes, recorded by Dr. Stone in the *Proceedings* of the British Association at York in 1881, took about 10,000 micro-ampères, or 10 milliwebers, through his head, from nape to forehead, after some practice; using for its production from 15 to 20 cells of a bichromate battery. The particular battery, however, mattered very little; Leclanché's, bichromates and zinc-carbons with sulphate of mercury, all act well, and need not be of large size or small resistance. One was shown, in which test-tubes filled with mercuric sulphate, containing free acid, formed the jars; another in which a rod of zinc of 5-16″ diameter, and a similar sized carbon, such as is used in electric lamps, were immersed in the bichromate solution. Connection was here made with the carbon by a piece of drawn tube sprung on to it, thus doing away with the use of clamps. All these, as well as most of the apparatus shown, were made in Dr. Stone's workshop, chiefly with his own hands.

In consequence of the high resistance of the skin, it was essential to give a large size to the poles employed for applying the current, &c. Amalgamated zinc, with the mixture of potter's clay kneaded with the solution of common salt, used in physiological experiments, laid over it, was perhaps, theoretically, the best; but powdered carbon placed in a bag and immersed in salt and water, answered equally well; or the surgical appliance termed Spongio-piline, a thick felt, backed by india-rubber, through which a well-tinned copper wire was threaded, so as to encompass its whole circumference without anywhere projecting so as to touch the cuticle. The poles could hardly be too large.

A convenient form of Thomson galvanometer with graduated shunts, due to Dr. Kilner, was shown, and also a simple but effective instrument for producing intermissions in the current at any required interval of time. This apparatus consisted of a